AI allows first direct observation of slow quakes moving through the earth

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A research team led by Bertrand Rouet-Leduc has used a neural network, a form of machine learning, to reveal the first direct observation of rupture propagation in the earth during a slow earthquake.

Why it matters. Applying machine learning, or artificial intelligence (AI), to interferometric synthetic aperture radar (InSAR) images opens up a new way to unravel the physics behind tectonic faults and earthquakes. That's key to understanding the full spectrum of earthquake behavior.

The research was presented Dec. 15 at the AGU Fall Meeting, which brings together earth and space scientists from around the world.

What's new? "The deep-learning approach we developed makes it possible to automatically detect, with unprecedented clarity, the small and transient deformation of the earth's surface that happens on faults, paving the way for a systematic study of the interplay between slow and regular earthquakes, at a global scale," said Rouet-Leduc. The project was funded by the Laboratory Directed Research and Development Program (LDRD).

How it works. The geophysicists from Los Alamos and the École Normale Supérieure in Paris trained the neural network to remove atmospheric "noise" in the data and extract ground deformation from InSAR data—images from the North Anatolian Fault in Turkey. The AI approach works without expert interpretation or previous knowledge of the fault system being studied.

InSAR is a satellite-based mapping technique that uses radar to create images of ground deformation. Unlike optical imaging systems, InSAR can "see" through clouds and works at night, but atmospheric turbulence and other distortions can skew the measurements of details on the earth's surface. The new deep-learning tool corrects for those distortions, and learns to distinguish signal from noise.

Read more about Los Alamos' work in earthquake science.

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